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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/648,777	08/28/2000	Song-Hua Shi	GTRC55	7737

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EXAMINER

NGUYEN, HA T

ART UNIT PAPER NUMBER

2812

DATE MAILED: 07/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/648,777

Applicant(s)

SHI ET AL.

Examiner

Ha T. Nguyen

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period of Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 06 May 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-53 is/are pending in the application.
- 4a) Of the above claim(s) 29-53 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Notice to applicant***

1. Applicants' Amendment and Response to the Office Action mailed 1-31-3 has been entered and made of record (Paper No. 10).

### ***Response to Amendment***

2. In view of Applicants' amendment to the claims, the objection to claims 11 and 25, has been withdrawn.

Applicants' arguments with regard to the rejections under 35 U.S.C. 103 have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicants argued that Gilleo et al. (U.S. Patent 6194788, hereinafter "Gilleo") and Lin et al. (U.S. Patent 6207475, hereinafter "Lin") are not combinable and even when combined does not teach the claimed invention. The examiner disagreed, Gilleo teaches an underfill material that can act as both an underfill material and a tacky flux material, Gilleo teaches that the height of the underfill when dried is less than the solder bumps, it also teaches that a portion of the tacky underfill material can be used to hold the chip in position (see col. 5, line 30-col. 6, line 19), the portion of underfill between the bumps is considered equivalent to the claimed WLCFU material while the portion of underfill material on the bump is considered equivalent to the claimed tacky film. Gilleo also discloses a reflow process, implying the solder bumps are reflowed at some point in the process, the underfill material is solidified, this can be interpreted as implying a curing process since it is well known in the art that resinous material is densified when cured. Because in Gilleo, the underfill portion and the tacky portion are from the same material, when cured the two portions are cured simultaneously. However because these steps are not expressly disclosed, Lin is used to clearly show what are implied by Gilleo, that reflowing the solder bumps and simultaneously cure the tacky material and the WLCFU are well known in the art. When combined the benefits stated in the rejection is obtained. Therefore, Gilleo and Lin are combinable and their combination does make obvious all the limitations of the claims rejected.

Applicants' arguments concerning the flip-chip assemblies and the reliability of the packaging are considered irrelevant since these features are not claimed. Besides, note that applicant's arguments are largely directed to what the cited references teach individually.

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However, it is axiomatic that one cannot show nonobviousness by attacking references individually where the rejection, as here, is based on a combination of references. *In re Young*, 403 F.2d 754, 159 USPQ 725 (CCPA 1968); *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). For example, applicant argues that Lin does not disclose applying the underfill material at the wafer level as here claimed. However, Gilleo, not Lin, is employed in the rejection to show that feature of the claimed process.

Applicants also argued that Yonemoto (JP Patent 61-138614) is a non-analogous reference, the examiner disagreed, Gilleo and Lin's underfill materials are resinous materials, Yonemoto's teaching concerns resinous material, it is an analogous reference.

Therefore the rejections of claims 1-28 is proper. Applicants are referred to the re-statement of the rejection below.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103<sup>®</sup> and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-12 and 15-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilleo et al. (U.S. Patent 6194788, hereinafter "Gilleo") in view of Lin et al. (U.S. Patent 6207475, hereinafter "Lin").

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[Claim 1] Gilleo discloses a wafer-level compressive- flow underfilling (WLCFU) process comprising the steps of: applying a WLCFU material onto a surface of a bumped wafer in an amount sufficient to ensure that the thickness of the solidified WLCFU layer is less than the height of the wafer bumps (see Fig. 2 and Summary); solidifying the WLCFU material (See col.5, lines 30-45 and col. 6, lines 3-13); separating the WLCFU material coated wafer into individual chips (See col. 6, lines 19-23); mounting the WLCFU material and tacky film coated individual chips to substrates (See col. 6, lines 13-43), the examiner interprets that the portion of the flux covering the bumps is equivalent to the claimed tacky film because the underfill is also a flux which may contain adhesive material. But Gilleo does not disclose expressly reflowing the solder bumps and curing the WLCFU material and tacky film simultaneously. However, the missing limitation is well known in the art because Lin discloses this feature (See col. 10, lines 13-32 ). A person of ordinary skill is motivated to modify Gilleo with Lin to obtain a reduction in fabrication time and cost.

[Claim 2] Gilleo also discloses wherein said WLCFU material is a solvent-containing WLCFU material and said solidifying step includes the step of solidifying said WLCFU material by solvent removal (see col. 5, lines 31-45 and col. 6, line 3-13);

[Claim 3] wherein said WLCFU material is a solvent-free fluxing WLCFU material and said WLCFU solidifying step includes the step of solidifying said WLCFU material by cooling (see col. 5, lines 51-60);

[Claim 4] further comprising a post-curing step (see col. 2, line 19-25 and col. 4, lines 49-64);

[Claims 5, 6, 19, and 20] wherein said WLCFU material comprises: an epoxy resin; an organic curing, hardener; a latent curing catalyst, a fluxing agent, and a silica filler ; wherein said epoxy resin is selected from the group consisting of- a cycloaliphatic epoxy resin, a bisphenol A epoxy resin, a bisphenol F epoxy resin, an epoxy novolac resin...; wherein said tacky film comprises: an epoxy resin; an organic curing hardener; a latent curing catalyst; and a fluxing agent; wherein said tacky film is selected from the group consisting of: a cycloaliphatic epoxy resin, a bisphenol A epoxy resin, a bisphenol F epoxy resin, an epoxy novolac resin, a biphenyl epoxy resin, a naphthalene epoxy resin, a dicyclopentadiene-phenol epoxy resin, a reactive epoxy diluent, and any mixture thereof (see col. 4, lines 2-18).

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[Claims 7 and 21] wherein said organic curing hardener is selected from the group consisting of: a phenolic resins, an aromatic amine, a carboxylic acid anhydride, an imidazole, and an imidazole derivative; wherein said organic curing hardener is selected from the group consisting of a phenolic resin, an aromatic amine, a carboxylic acid anhydride, an imidazole, and an imidazole derivative (see col. 8, lines 4-15);

[Claims 8 and 22] wherein said curing catalyst is selected from the group consisting of: a tertiary amine, a tertiary phosphine, an imidazole, an imidazole derivative, an imidazolium salt, a meta chelate, an onium salts, a quaternary phosphonium compound, 1,8-diazacyclo[5.4.0]undec-7-ene, and any mixture thereof (see col. 8, lines 4-15);

[Claims 9, 10, 23, and 24] wherein said fluxing agent comprises a compound containing a hydroxyl (-OH) group; wherein said fluxing agent comprises a compound containing a carboxylic (-COOH) group; wherein said fluxing agent comprises a compound containing a hydroxyl (-OH) group; wherein said fluxing agent comprises a compound containing a carboxylic (-COOH) group (see col. 4, lines 3-17);

[Claim 11] wherein said filler is selected from the group consisting of: a spherical fused silica filler, a silicon nitride filler, a silver flake filler, and a gold flake filler with diameters ranging from 0.1  $\mu\text{m}$  to 50  $\mu\text{m}$  (see col. 4, lines 22-40);

[Claim 12] wherein said WLCFU material further comprises a solvent (see col. 5, lines 30-45); and

[Claims 15, 17, 18, 25, 27, and 28] wherein said WLCFU material further comprises an adhesion promoter; wherein said WLCFU material further comprises a surfactant (see col. 4, lines 3-17); besides, it would have been obvious to use a non-ionic surfactant because the composition is an organic composition.

[Claims 16 and 26] Gilleo also discloses wherein said adhesion promoter is selected from the group consisting of: a silane coupling agent, a titanate, and a zirconate (see ex. 2, col. 8, lines 18-28).

Therefore, it would have been obvious to combine Gilleo with Lin to obtain the invention as specified in claims 1-12 and 15-28.

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5. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gilleo in view of Lin, as applied to claims 1-12 and 15-28 above, and further in view of Yonemoto (JP Patent 61-138614).

The combined teaching of Gilleo and Lin discloses the limitations of claims 13 and 14, as shown above.

But it does not disclose expressly wherein said solvent is an organic chemical having a boiling point between 25°C to 200°C which does not react with any other components in the WLCFU composition/formulation; wherein said solvent is 4-methyl-2-pentanone.

However, the missing limitations are well known in the art because Yonemoto discloses these features (See Constitution).

A person of ordinary skill is motivated to modify Gilleo and Lin with Yonemoto to use conventional solvent of well known characteristics in the composition to ensure controllability.

Therefore, it would have been obvious to combine Gilleo and Lin with Yonemoto to obtain the invention as specified in claim 13 and 14.

### ***Conclusion***

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

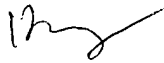
7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (703)308-2706. The

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examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling, can be reached on (703) 308-3325. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



Ha Nguyen

Primary Examiner

6- 27- 03